KING COUNTY CONVEYANCE SYSTEM IMPROVEMENT PROJECT

TASK 230

CHARACTERIZATION OF SOUTH SAMMAMISH BASIN EXISTING CONDITIONS

October 2003

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CHARACTERIZATION OF SOUTH SAMMAMISH BASIN EXISTING CONDITIONS

This memorandum characterizes the physical and natural environment, identified sensitive areas, and basin natural resources of the South Sammamish Basin. In addition, basin land use and growth impacts are identified. This planning and project identification effort includes a description of geological, biological, and other environmentally sensitive conditions in the service area that may affect construction of conveyance systems to extend current service capabilities. Population and land use data from King County and the Cities of Bellevue, Issaquah, and Sammamish were reviewed and summarized in this memorandum. Potential constraints to implementation of the King County Conveyance System Improvement (CSI) project have been identified. Current and future land use conditions in the service area and land use constraints that may affect the CSI project are discussed. Five sewer sub-basins, which include Lake Hills, Sunset, Eastgate, Issaquah, and Sammamish Plateau, define the South Sammamish Basin (Figure 1). These sub-basins lie within the jurisdictions of King County and the Cities of Bellevue, Issaquah, and Sammamish.

NATURAL ENVIRONMENT

The topography, geology, water features, and the presence of wildlife habitat within the South Sammamish Basin can all potentially impose constraints on construction of wastewater conveyance facilities within the basin.

Earth/Geological Features

Topography and Soils

Several relatively steep slopes (slopes in excess of 40 percent) exist in the service area. Most of the steep slopes are concentrated within the Eastgate and Issaquah sewer basins. Natural features contributing to these slopes include steep slopes on the northeast side of Cougar Mountain, the north side of Squak Mountain, and slopes on the northwest side of East Tiger Mountain. The remainder of the service area is characterized by an alluvial floodplain (to the south of Lake Sammamish) and various hilly plateaus, with numerous depressions filled by lakes, wetlands, and bogs.

Many types of soils exist throughout the service area due to the extensive area occupied by the five sewer basins. The following is a general description of the dominant soils found in the service area as depicted by the National Resource Conservation Service (NRCS) (1973), formerly known as the Soil Conservation Service. Terrain west of Lake Sammamish (including the Lake Hills, Eastgate, and Sunset sewer basins) is mostly composed of Beausite gravelly sandy loam (6 to 15 and 15 to 30 percent slopes) and Alderwood gravelly

Sammamish silt loam. The dominant soil type within the Sammamish Plateau sewer basin is Alderwood gravelly sandy loam (6 to 15 percent slopes).

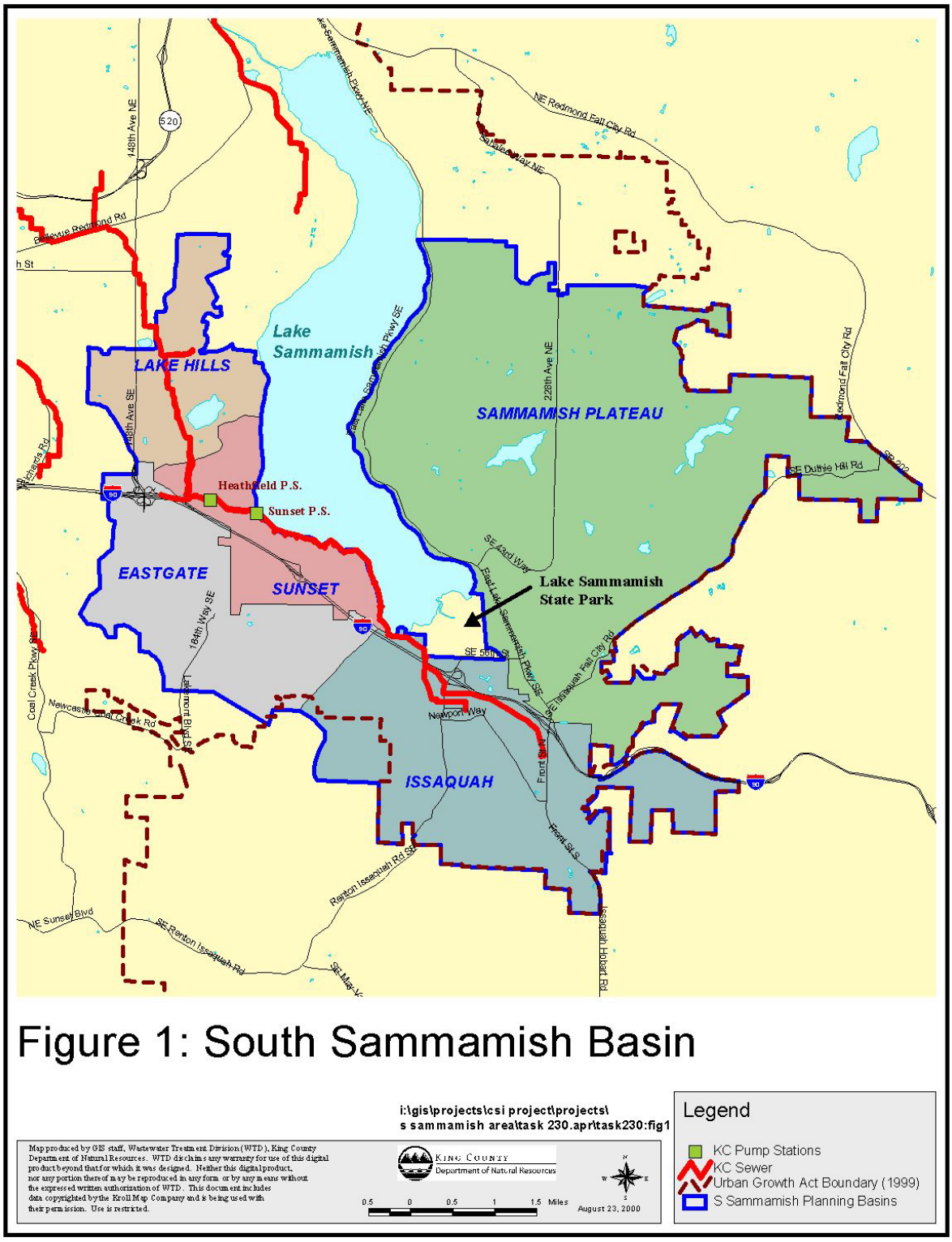

Figure 1: South Sammamish Basin

Erosion Hazards

The susceptibility of any soil type to erosion depends upon the physical and chemical characteristics of the soil, its vegetative cover, slope length and gradient, intensity of rainfall, and the velocity of water runoff. Significant erosion in the service area is most likely to occur along the steep slopes of the mountainous regions, the Issaquah Creek Valley, steep slopes to the east of Lake Sammamish, and terrain around Pine Lake.

The *King County Sensitive Areas Map Folio* (1990) has identified several erosion hazard areas in the basin (Figure 2) due to steep slopes. Erosion hazard areas are defined as those areas composed of soils that may experience severe to very severe erosion hazards. The *Sensitive Areas Folio* lists several types of soils identified by the NRCS that tend to experience severe to very severe erosion hazards. Alderwood gravelly sandy loam (0 to 15 percent slopes) is listed as prone to erosion, and is dispersed throughout the Sammamish Plateau sewer basin. Beausite gravelly sandy loam (15 to 30 percent slopes) is another soil type described as susceptible to erosion hazards and is one of the dominant soil types found within the Eastgate and Issaquah sewer basins. Another soil susceptible to soil erosion, Kitsap silt loam (15 to 30 percent slopes), is documented within the Issaquah sewer basin, to the west of the City of Issaquah.

Erosion hazard areas identified in the service area include the steep slopes of Cougar Mountain, Squak Mountain, East Tiger Mountain, and steep terrain along the Interstate 90 corridor within the Eastgate and Sunset Sewer Basin are potential erosion hazard areas. Just south of Lake Sammamish, the deeply incised valley that contains Issaquah Creek and a portion of the City of Issaquah is prone to erosion. Finally, the Sammamish Plateau sewer basin includes potential erosion hazard areas along the west side of the basin, around Pine Lake, and along steep slopes to the east of Beaver Lake.

Stream erosion is a potential concern within the South Sammamish Basin. On Cougar Mountain, steep slopes and shallow soils are subject to undercutting and slippage even under natural conditions. The problems are being aggravated by construction, increases in runoff, and channeling of flows into fewer drainageways. The outlet of Phantom Lake, located in the Lake Hills sewer basin, is receiving increased flows, probably as a result of development of commercial property near I-90. This is the only tributary on the drift plain identified as currently experiencing serious stream erosion. Because the western part of the South Sammamish Basin is characterized by very steep slopes, urbanization has disturbed natural ground cover and produced additional impervious surfaces. This process, together with increasing runoff, has contributed to the erosion and sedimentation problems within the service area (King County, 1987).

Activities associated with clearing, grading, and construction will contribute to erosion and sedimentation potential. Following any construction activity, if the site is stabilized and re-vegetated, and drainage systems are in place and functioning, impacts caused by erosion would be relatively minor.

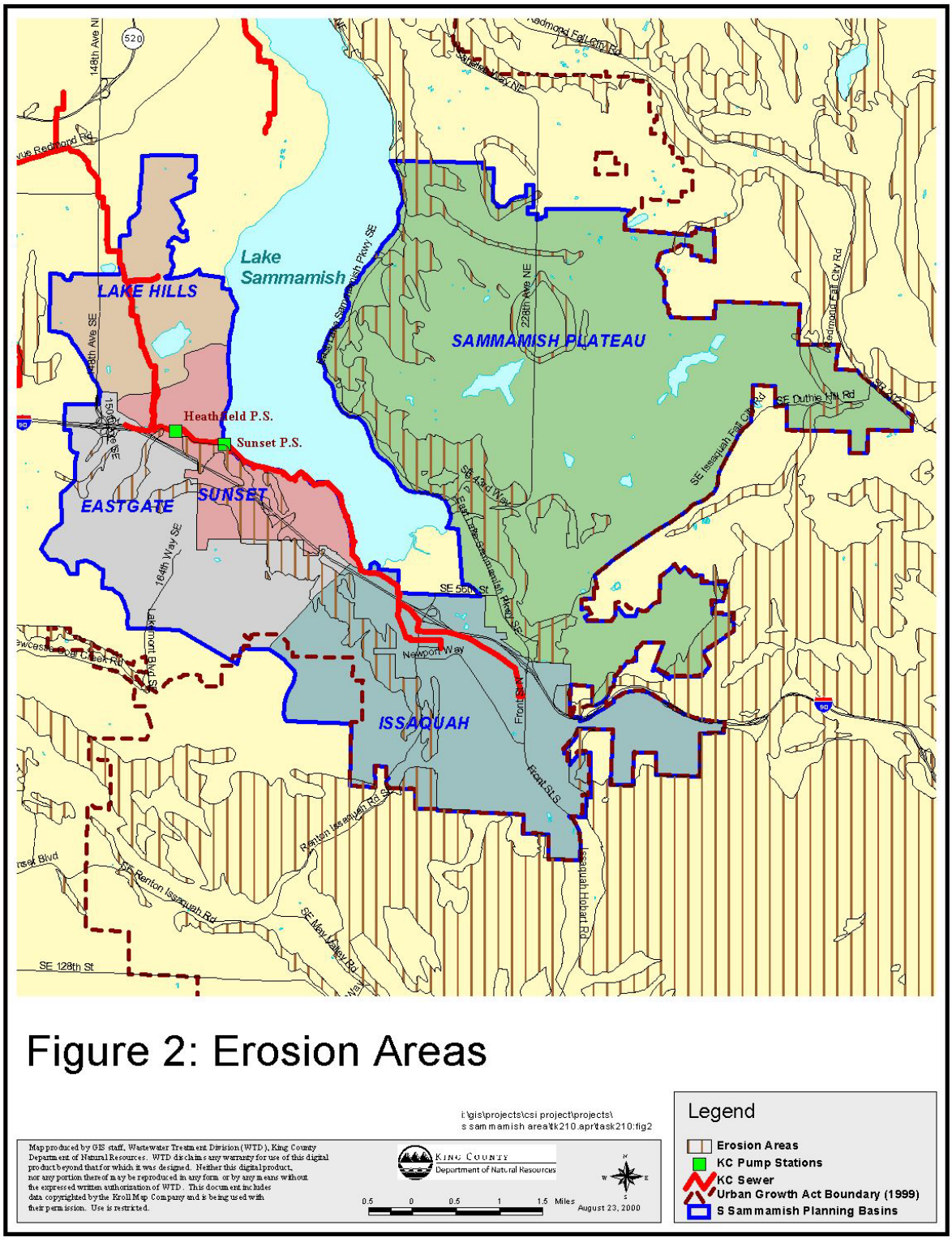

Figure 2: Erosion Areas

Landslide Hazards

Landslide hazard areas are defined as areas with a combination of slopes with a greater than 15 percent slope gradient, impermeable soils, and groundwater seepage. Areas with a history of rapid stream incision, stream bank erosion, or undercutting by wave action were also designated, as well as areas with a geological history that would indicate landslide susceptibility. The *King County Sensitive Areas Map Folio* (1990) has identified landslide hazard areas within the service area (Figure 3). These areas are characterized by steep slopes associated with mountainous terrain and include various locations throughout the service area. The City of Issaquah *Critical Areas Maps* (1990) has identified the steep slopes of East Tiger Mountain and Cougar Mountain as potential landslide hazard areas within the Issaquah city limits.

Seismic Hazards

Seismic hazards are those areas subject to severe risk of earthquake damage as a result of settlement or soil liquefaction. These conditions occur in areas underlain by soils with low cohesion and density, usually in association with a shallow groundwater table. When shaken by an earthquake, certain soils lose their ability to support a load. Loss of soil strength can also result in failure of the ground surface and damage to structures supported in or on the soil. Loose, water-saturated materials are the most susceptible to ground failure due to earthquakes.

The King County *Sensitive Areas Map Folio* (King County, 1990) identified areas around the entire perimeter of Lake Sammamish, the Issaquah Creek valley, and an area to the east of the Sammamish Plateau as susceptible to a potential seismic hazard (Figure 4). The City of Issaquah *Critical Areas Maps* (1990) documents a majority of the city limits within potential seismic hazard areas, with Cougar Mountain, Squak Mountain, and East Tiger Mountain as the boundary outside seismic activity.

Hazardous Materials

Some businesses in the South Sammamish Basin, such as service stations, manufacturers, paint supply stores, etc., likely use and store hazardous materials. Because the majority of the basin is residential and commercial, the likelihood of encountering hazardous materials is minimal during construction. Areas adjacent to Lake Sammamish include former lumber-related industries with hazardous material usage. Areas of contaminated soils have been identified along the former Burlington Northern Santa Fe (BNSF) rail line adjacent to Lake Sammamish, according to preliminary evaluations conducted as part of the East Lake Sammamish Trail investigations.

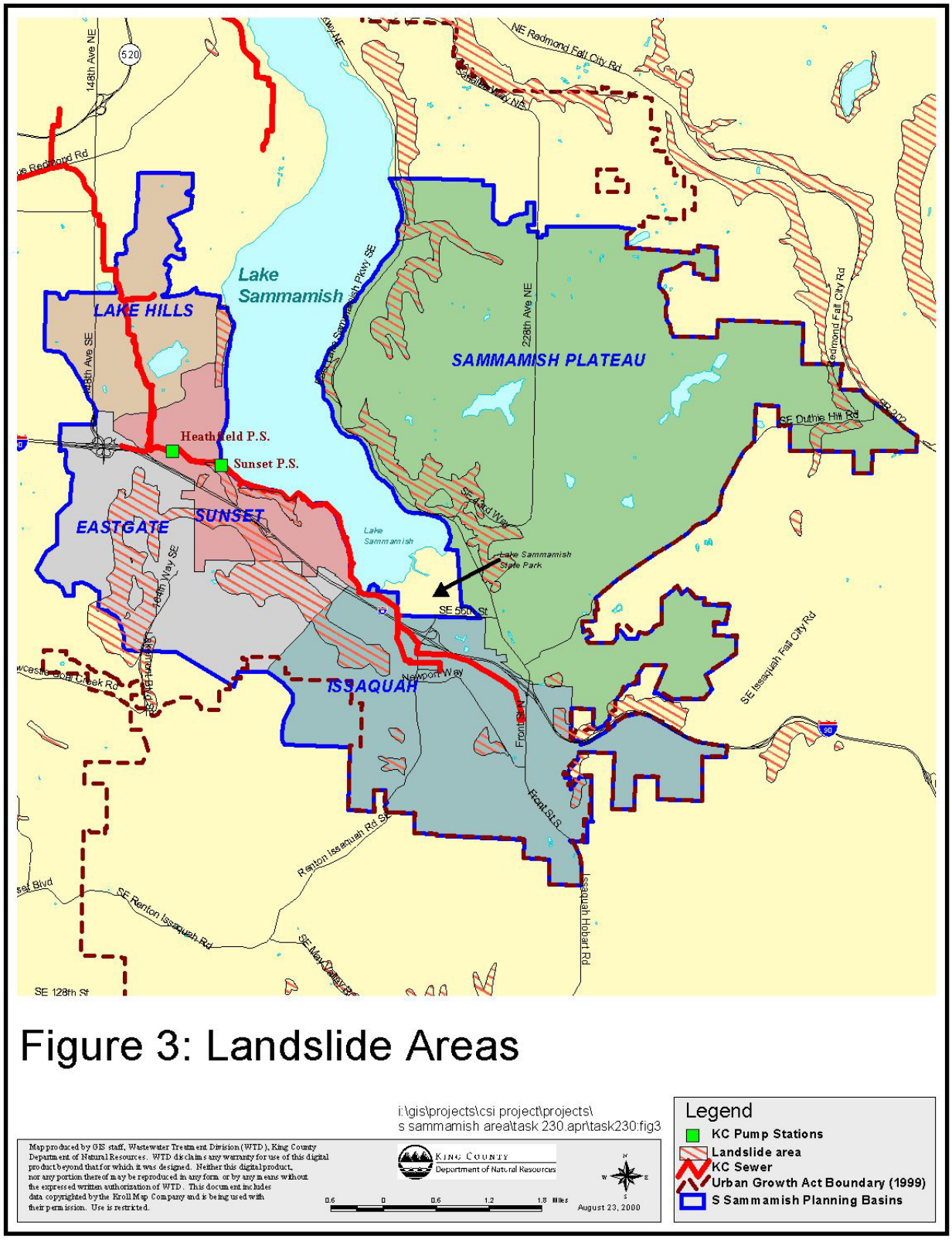

Figure 3: Landslide Areas

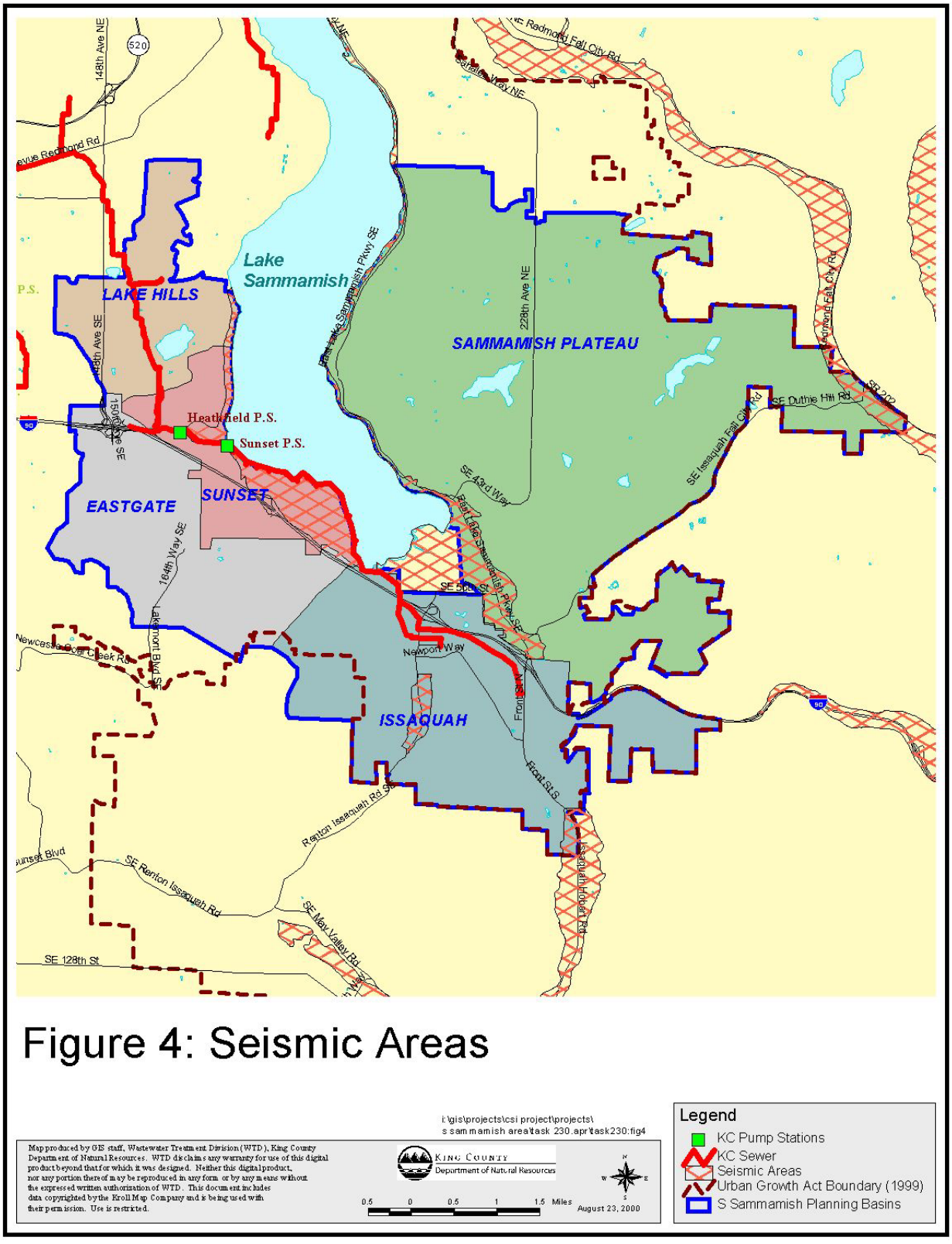

Figure 4: Seismic Areas

Cultural and Historical Resources

Preliminary evaluations conducted by King County as part of the East Lake Sammamish Trail investigations have documented indications of historic cultural resources within the Sammamish Plateau sewer basin. The Snoqualmie Tribe is noted as including several sites within the Sammamish Plateau sewer basin as culturally significant. It will be important to initiate discussions with appropriate tribal government representatives during specific project predesign efforts.

Water Features

Surface Water Basins

The South Sammamish Basin is located within Water Resource Inventory Area (WRIA) 8 (the Lake Washington Basin) and includes either all or part of eleven sub-basins that fall within WRIA 8. The sub-basins include Kelsey Creek, Mercer Slough, West Lake Sammamish, Tibbetts Creek, Issaquah Creek, East Fork Issaquah Creek, North Fork of Issaquah Creek, Patterson Creek, East Lake Sammamish Basin, and Evans Creek. Water flowing within the service area discharges directly into Lake Sammamish.

The Lake Sammamish drainage basin is described as a long, uniform trough with steeply sloping sides that runs essentially south to north. The major stream system in the basin is Issaquah Creek, which provides approximately 70 percent of the annual inflow into Lake Sammamish (King County, Department of Natural Resources, 1998).

Streams and Creeks

Several streams and creeks flow throughout the Lake Sammamish drainage basin and vary in terms of classification. The King County *Sensitive Areas Map Folio* (1990) lists Issaquah Creek as the only Class 1 stream in the vicinity of the South Sammamish Basin. Class 1 streams are defined as those inventoried as "Shorelines of the State" under King County's Shoreline Master Program. Furthermore, 15 streams surrounding Lake Sammamish are identified as Class 2 streams, with salmonids. A few of the streams with documented accounts of salmonids include George Davis Creek, Zaccuse Creek, Pine Lake Creek, Issaquah Creek, and Tibbett's Creek (King County, Surface Water Management Division, 1994). The Class 2 streams are identified as those smaller than Class 1 streams and flow year-round during years of normal rainfall. Several unclassified streams are also documented in the basin. Unclassified streams are those streams for which a watercourse has been identified but defining characteristics have not been determined.

The southern section of the South Sammamish Basin covers large and complex basins that drain a mountainous region. Creeks flowing from the mountains are typically intermittent and have steep gradients. During storms, creeks rise and recede quickly. The large sediment loads that they carry are deposited downstream on the flatter areas of the floodplain.

Stream Flow Statistics

The King County Surface Water Management (WLRD) Division Stream Monitoring Program has collected data from various streams in the County since 1987. Data is gathered from stream gauges, which record stream flow in cubic feet per second (cfs) for various locations and years. The stream gauges are maintained and data loggers are uploaded at least ten times and year. Intermediate site visits are made during rain storms to obtain high flow discharge. Table 1 presents stream flow data from King County for various streams within the King County South Sammamish Basin Service Area.

Table 1. Stream Flow Data: South Sammamish Basic Service Area

Average Stream Flows (cfs) from the North Fork of Issaquah Creek from 1988-1992, & 1994											
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
16.47	10.6	10.52	10.78	3.47	3.78	1.57	1.37	1.24	2.38	8.11	8.53

Average Stream Flows (cfs) from the East Fork Issaquah Creek from 1988-1994											
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
38.8	33.85	33.41	30.57	13.87	14.15	5.65	3.44	3.07	5.0	28.23	25.31

Average Stream Flows (cfs) from Laughing Jacobs Creek from 1992-1994											
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
6.74	9.35	6.23	6.02	2.91	1.65	0.83	0.40	0.47	0.71	2.61	5.11

Average Stream Flows (cfs) from the Northeast Beaver Lake Inlet for 1998											
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.63	.50	.79	.29	.17	.07	.02	0.00	0.00	.27	.34	.52

Average Stream Flows (cfs) from the North Beaver Lake Inlet for 1998.											
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2.70	.81	.98	.40	.18	.12	.03	.00	.00	.49	.89	1.05

Average Stream Flows (cfs) from the Beaver Lake Outlet for 1998.											
Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
6.03	1.75	2.12	1.56	.51	.15	.00	.00	.00	.03	1.39	2.03

Source: King County Water and Land Resources Division, Department of Natural Resources.

Shoreline

The King County *Sensitive Areas Map Folio* (1990) classifies the Lake Sammamish shoreline within the service area as Class 1. The Class 1 designation indicates that the waterway is listed and inventoried as a "Shoreline of the state" under the King County Shoreline Master Program, and has a 100-foot buffer requirement.

King County (1978) designates the shoreline of Lake Sammamish into three categories: Urban Shoreline, Rural Shoreline, and Conservancy Shoreline. The purpose of the Urban Shoreline designation is to "ensure optimum utilization of shorelines within urbanized areas by permitting intensive use and by managing development so that it enhances and maintains the shoreline for a multiplicity of urban uses." The purpose of the Rural Shoreline is to "restrict intensive development along undeveloped shorelines, function as a buffer between urban areas, and maintain open spaces and opportunities for recreational uses within the ecological carrying capacity of the land and water resource." Conservancy Shoreline areas are intended to "maintain their existing character."

The recently incorporated City of Sammamish currently uses the same shoreline designations of King County until a Shoreline Master Program for the city is adopted. The City of Issaquah has designated the shoreline environment of Lake Sammamish as Conservancy Riparian within the city limits. The Conservancy Riparian designation refers to areas where land uses "shall maintain riparian vegetation and provide water quality and habitat benefits" (City of Issaquah, 1990). The City of Bellevue does not have a shoreline designation for Lake Sammamish.

Groundwater

Groundwater conditions vary widely within the basin, due to variable geologic and topographic conditions. Groundwater in the alluvial plains at the east and south ends of Lake Sammamish occurs at shallow levels (from 0 to 15 feet below grade) within fine to medium-grained sediment. The shallow groundwater aquifer surrounding the lake shore is hydraulically connected, at varying degrees, with the lake. Infrastructure development in some areas near the shoreline or inlet streams to the lake (e.g., Issaquah Creek) and where the aquifer is relatively permeable may require extensive dewatering controls during construction.

Along the hill slopes above the lake, groundwater seeps may occur in many areas that discharge into small creeks that flow into Lake Sammamish. Shallow, perched groundwater may occur within the uppermost 10 feet of soil and weathered glacial till on the plateau areas surrounding the lake. Shallow groundwater or saturated soil (wetland) conditions may also occur on the plateau areas within topographic depressions near lake shorelines (e.g., Phantom Lake, Pine Lake) or along stream valleys. The shallow groundwater at the plateau areas typically occur within fine-grained sediment which yield limited quantities of groundwater. Infrastructure development in these areas may only require short-term, low volume dewatering controls during construction.

Higher yield groundwater aquifers in the plateau areas generally occur deeper than 100 feet. Infrastructure development, therefore, would not likely encounter or affect these aquifers unless construction would occur at that depth.

Subgrade construction that occurs below the water table may potentially alter groundwater flow directions, either by creating preferential pathways for ground water flow, or diverting groundwater away from pre-construction discharge areas. Other construction activities may also affect pre-construction groundwater flow by altering shallow groundwater recharge rates due to surface pavement.

Ground Water Recharge Potential

Surface water and precipitation may infiltrate into the subsurface, potentially recharging underlying ground water aquifers depending on the permeability of surface soil and shallow geologic units. Paving and building construction will significantly modify surface permeability. Stormwater detention and infiltration structures, and subsurface utilities will artificially redirect surface infiltration into or away from natural recharge areas.

Areas of High Recharge Potential. Surface water and precipitation may rapidly infiltrate vertically downward into sand and gravel layers of advance glacial outwash that outcrop at the upper portions of the slopes. The infiltrated water then migrates vertically downward and recharges the regionally extensive advance outwash aquifer, which underlies much of the plateau areas surrounding the lake.

Surface water may percolate into the high permeability sand and gravel of recessional outwash units, which also occur locally along slopes or the top of the plateau areas. Although water may rapidly infiltrate in these areas, the underlying water-bearing zones in the recessional outwash aquifers tend to be thin, discontinuous, and localized, often times perched on top of low permeability glacial till. The recharge potential for these areas is high, but the relatively small extent of recessional aquifers will limit the quantity of recharge.

Areas of Moderate Recharge Potential. The moderately permeable silt and sand layers within alluvium at the east and south ends of Lake Sammamish permit moderate infiltration of surface water to the underlying shallow aquifer. The silt content varies widely in the alluvium, resulting in wide variation in recharge potential.

Areas of Low Recharge Potential. Surface water tends to run off, rather than infiltrate into the lower permeability pre-glacial silt and fine sand that outcrop on the lower portion of the slopes. Little infiltration occurs in these areas, resulting in low recharge potential.

Low permeability glacial till generally covers the top of the plateau areas, which limits surface water infiltration and subsequent recharge of ground water aquifers in the underlying advance glacial outwash units. High potential recharge areas correspond to high permeability sand and gravel of regional advance outwash units and local recessional glacial outwash units. Moderate potential recharge areas correspond to moderate permeability alluvium along the lake shoreline and streams flowing into the lake. Low potential recharge

areas correspond to low permeability pre-glacial sediment on lower hill slopes and glacial till at the top of the plateau areas.

Flood Hazard Areas

The King County *Sensitive Areas Map Folio* (1990) documents the potential flood hazard areas within the South Sammamish Basin. The flood hazard areas are located within a 100-year floodplain, defined as an area that has a one percent probability of inundation in any given year. Within the basin, the majority of flood hazard areas are located within the floodplain of Issaquah Creek (Figure 5).

The City of Issaquah's location presents a number of surface drainage concerns. Few topographic barriers impede flooding in the lower part of the basin, where the city is situated on a broad, fan-shaped accumulation of stream sediments. Consequently, a considerable area beyond the immediate Issaquah Creek stream system is subject to sheet flow. Sheet flow is shallow and is controlled by the artificial system of road ditches, swales, and the filled areas and excavation associated with development. Sheet flow rarely results in hazardous conditions, except on high-speed arterials (City of Issaquah, 1990).

Under current conditions, approximately 362 structures would be flooded by the 100-year flood under current conditions, of which 212 are residences. More than 90 percent of these structures are located within the city limits of Issaquah, where the corridors of the mainstream and the East Fork of Issaquah Creek, and Tibbetts Creek are heavily developed (King County Surface Water Management Division, 1994).

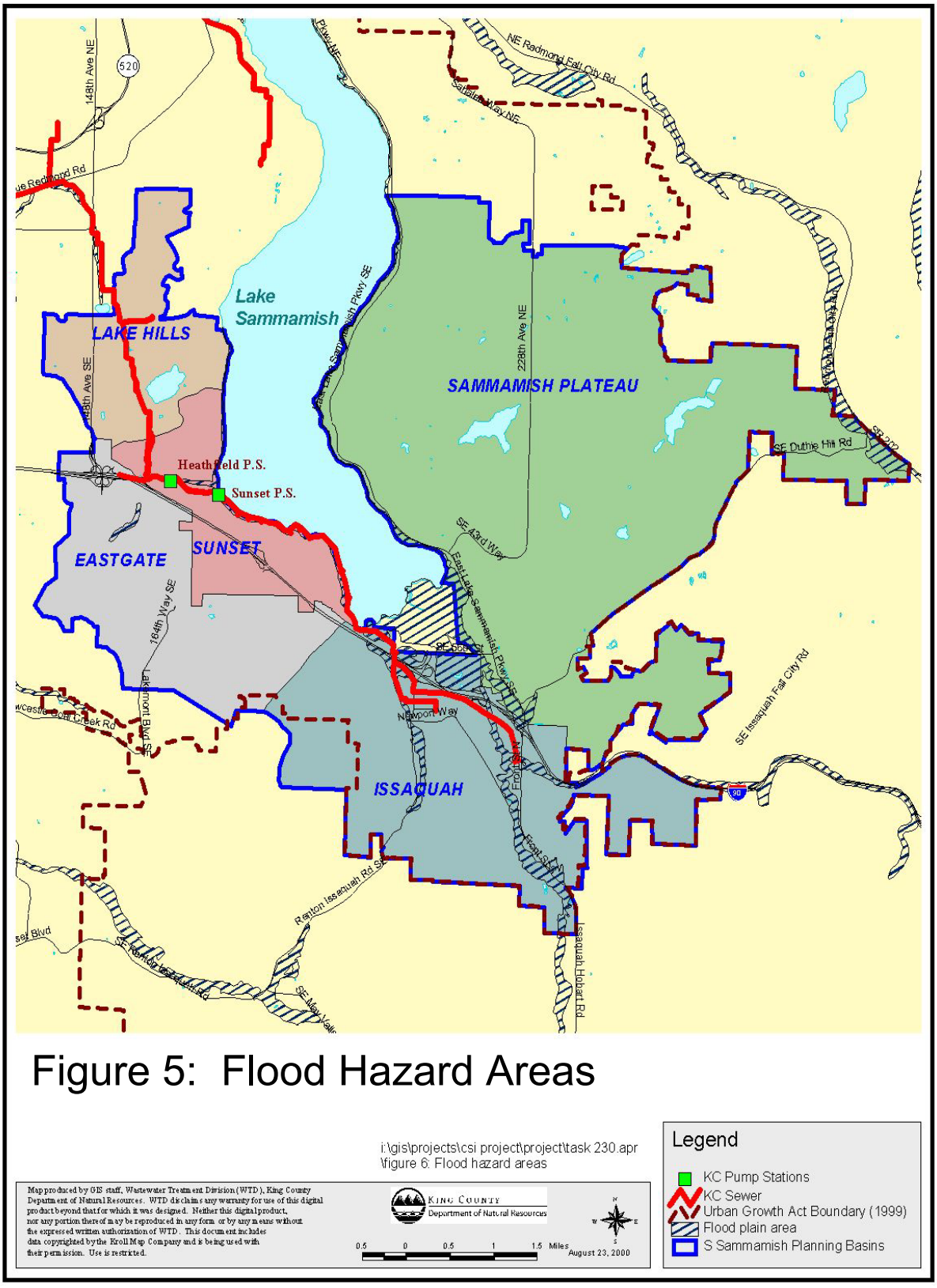

Figure 5: Flood Hazard Areas

Wetlands

Wetlands are unique environments comprised of diverse terrestrial and semi-aquatic habitats. Biological habitat support refers to a wetland's provision of nesting, breeding, rearing, and feeding habitat for aquatic and terrestrial wildlife species. Wetland systems within the South Sammamish Basin offer pockets of habitat for urban wildlife and wetland-dependent plant and animal species. A wetland's size, water quality, diversity of habitat, and habitat structure affect performance and function.

A review of background information, including the King County *Sensitive Areas Map Folio* (1990), *National Wetlands Inventory Maps* (1988, 1989, and 1990), the *Bellevue Sensitive Areas Notebook* (1987), and the *Issaquah Creek Watershed Management Committee Proposed Basin and Nonpoint Action Plan* (1994) has identified several wetlands within the basin (Figure 6). These wetlands include lacustrine systems, (the largest include Phantom Lake, Pine Lake, and Beaver Lake), riverine systems (found adjacent to many streams and creeks), and various palustrine systems (predominately located within the Sammamish Plateau and Issaquah sewer basins).

Numerous, smaller wetlands may exist throughout the basin that have not been identified (documented). While individually these areas may be small, their cumulative value to provide wildlife habitat, stormwater and floodwater storage and alteration, and groundwater exchange should not be overlooked. These areas may include regularly mowed, low, wet areas in backyards and parks, relatively undisturbed steep areas along the banks of Tiger Mountain, Squak Mountain, or Cougar Mountain, and wetland areas along the shore of Lake Sammamish.

Threatened and Endangered Species

Threatened and endangered species have been documented throughout the South Sammamish Basin. Therefore, potential project-specific consistency with the Endangered Species Act (ESA) is of concern. Chinook salmon will likely be the most significant concern because the species is currently listed as threatened and documented throughout Issaquah Creek and East Fork Issaquah Creek (Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes, 1994). Additionally, 15 salmon-bearing streams exist in the service area, which include Issaquah Creek, Pine Lake Creek, and Tibbett's Creek in the Sammamish sewer basin. Some other sensitive species likely or known to occur within the basin include peregrine falcons, western pond turtles, purple martins, pileated woodpeckers, great blue heron, and bald eagles.

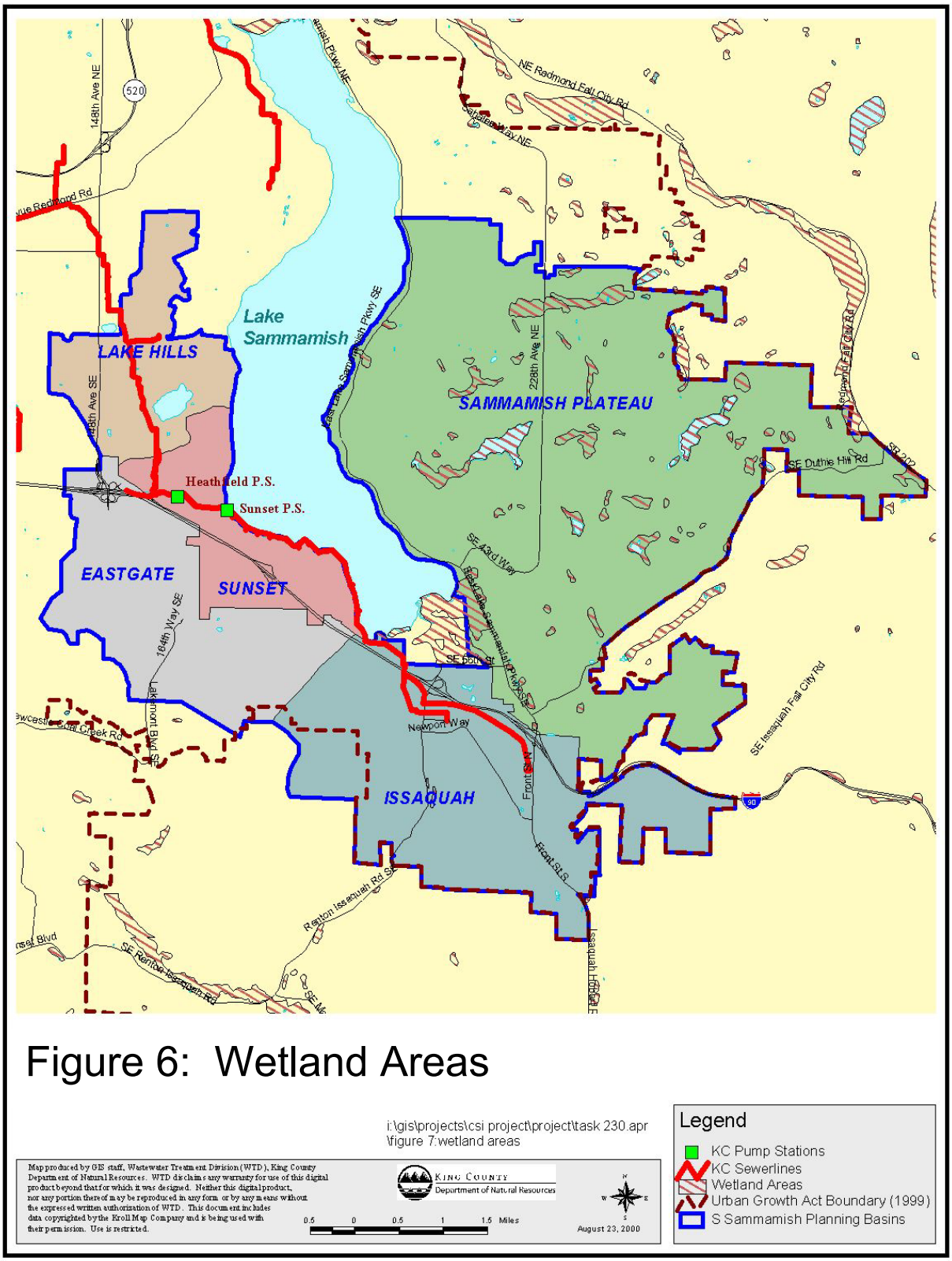

Figure 6: Wetland Areas

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